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DATA SHEET

BLF542
UHF power MOS transistor

Product specification

October 1992

Philips
Semiconductors

PHILIPS

UHF power MOS transistor BLF542

FEATURES

- High power gain
- Easy power control
- Gold metallization
- Good thermal stability
- Withstands full load mismatch
- Designed for broadband operation.

DESCRIPTION

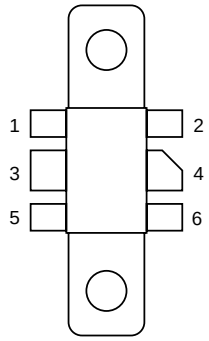
Silicon N-channel enhancement mode vertical D-MOS transistor designed for large signal amplifier applications in the UHF frequency range.

The transistor is encapsulated in a 6-lead, SOT171 flange envelope, with a ceramic cap. All leads are isolated from the flange.

PINNING - SOT171

PIN	DESCRIPTION
1	source
2	source
3	gate
4	drain
5	source
6	source

PIN CONFIGURATION



Top view MBA931 - 1

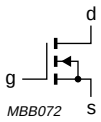


Fig.1 Simplified outline and symbol.

CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

QUICK REFERENCE DATA

RF performance at T_{mb} = 25 °C in a common source test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	P_L (W)	G_P (dB)	η_D (%)
CW, class-B	500	28	5	> 13	> 50

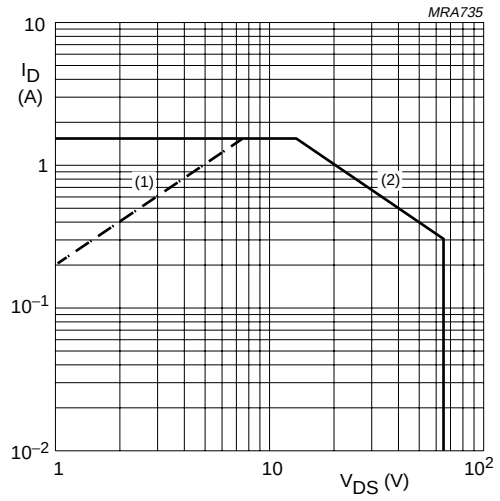
LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage		–	65	V
$\pm V_{GS}$	gate-source voltage		–	20	V
I_D	DC drain current		–	1.5	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	20	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

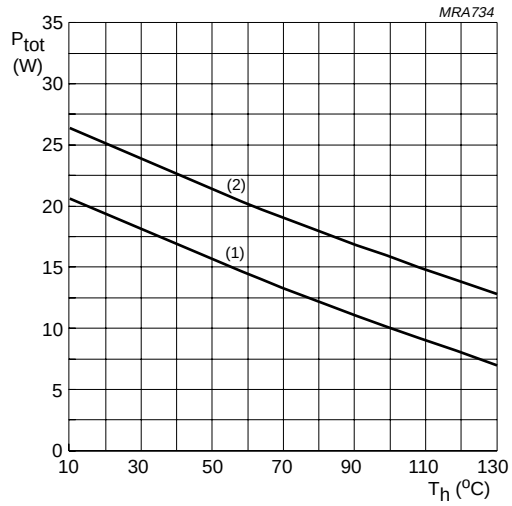
THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}mb}$	thermal resistance from junction to mounting base	8.8 K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink	0.4 K/W



(1) Current in this area may be limited by $R_{DS(on)}$.
(2) T_{mb} = 25 °C.

Fig.2 DC SOAR.



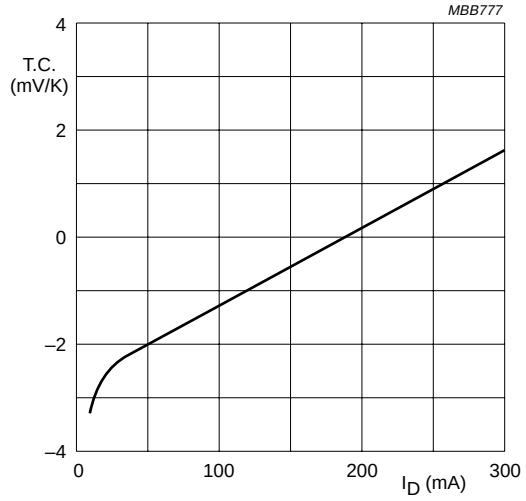
(1) Continuous operation.
(2) Short time operation during mismatch.

Fig.3 Power derating curves.

CHARACTERISTICS

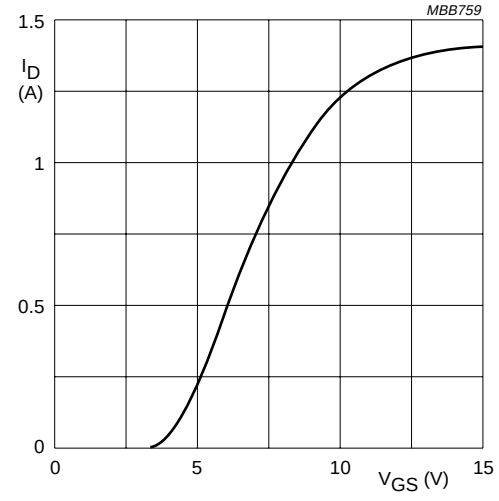
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.1 mA; V_{GS} = 0	65	–	–	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = 28 V	–	–	10	μA
I_{GSS}	gate-source leakage current	±V_{GS} = 20 V; V_{DS} = 0	–	–	1	μA
$V_{GS(th)}$	gate-source threshold voltage	I_D = 10 mA; V_{DS} = 10 V	2	–	4.5	V
g_{fs}	forward transconductance	I_D = 0.3 A; V_{DS} = 10 V	160	240	–	mS
$R_{DS(on)}$	drain-source on-resistance	I_D = 0.3 A; V_{GS} = 15 V	–	3.3	5	Ω
I_{DSX}	on-state drain current	V_{GS} = 15 V; V_{DS} = 10 V	–	1.4	–	A
C_{is}	input capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	14	–	pF
C_{os}	output capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	9.4	–	pF
C_{rs}	feedback capacitance	V_{GS} = 0; V_{DS} = 28 V; f = 1 MHz	–	1.7	–	pF



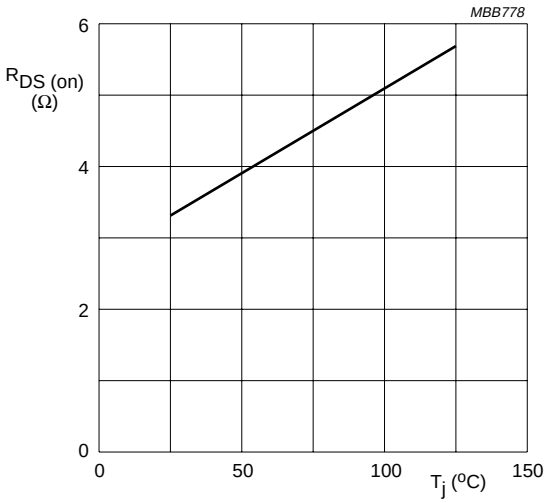
V_{DS} = 10 V.

Fig.4 Temperature coefficient of gate-source voltage as a function of drain current, typical values.



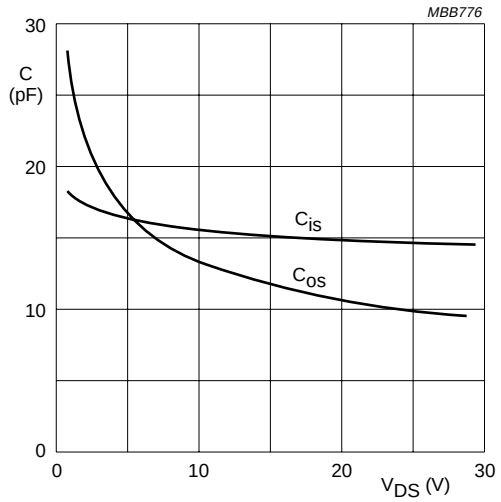
V_{DS} = 10 V; T_j = 25 °C.

Fig.5 Drain current as a function of gate-source voltage, typical values.



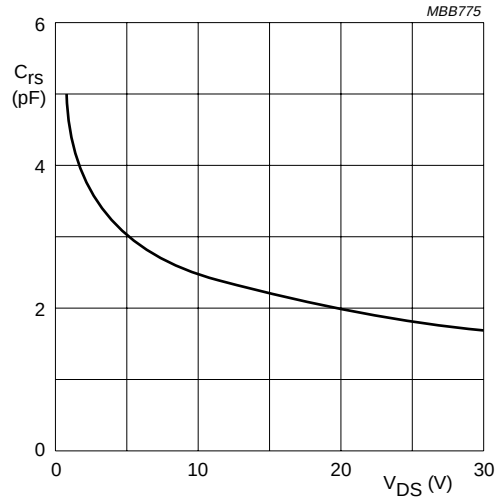
I_D = 0.3 A; V_{GS} = 15 V

Fig.6 Drain-source on-resistance as a function of junction temperature, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.7 Input and output capacitance as functions of drain-source voltage, typical values.



V_{GS} = 0; f = 1 MHz.

Fig.8 Feedback capacitance as a function of drain-source voltage, typical values.

APPLICATION INFORMATION FOR CLASS-B OPERATION

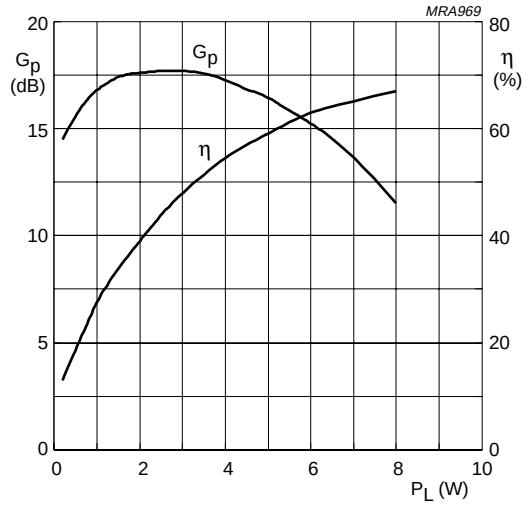
T_{mb} = 25 °C unless otherwise specified.

RF performance in CW operation in a common source class-B test circuit.

MODE OF OPERATION	f (MHz)	V_{DS} (V)	I_{DQ} (mA)	P_L (W)	G_P (dB)	η_D (%)
CW, class-B	500	28	50	5	> 13 typ. 16.5	> 50 typ. 59

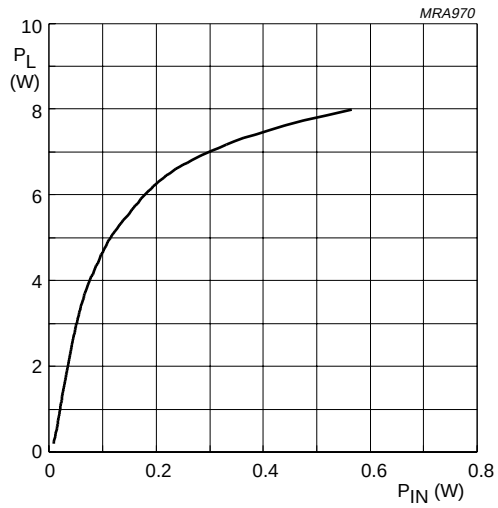
Ruggedness in class-B operation

The BLF542 is capable of withstanding a full load mismatch corresponding to VSWR = 50:1 through all phases under the following conditions: V_{DS} = 28 V; f = 500 MHz at rated output power.



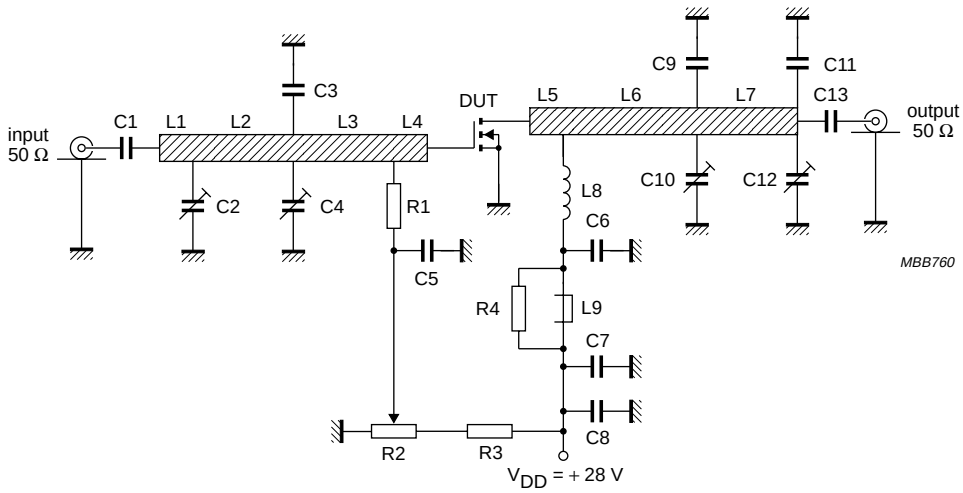
Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

Fig.9 Power gain and efficiency as functions of load power, typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA; Z_L = 9.7 + j24.5 Ω; f = 500 MHz.

Fig.10 Load power as a function of input power, typical values.



f = 500 MHz.

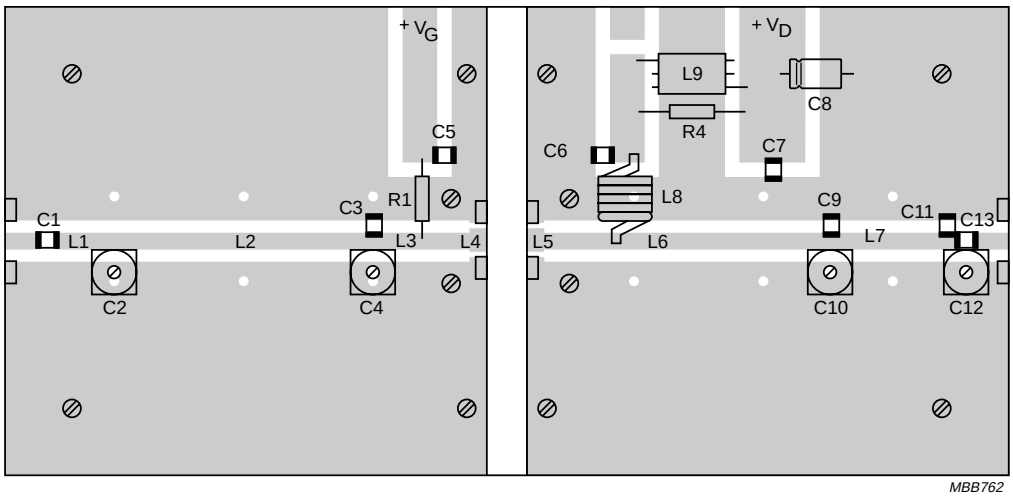
Fig.11 Test circuit for class-B operation.

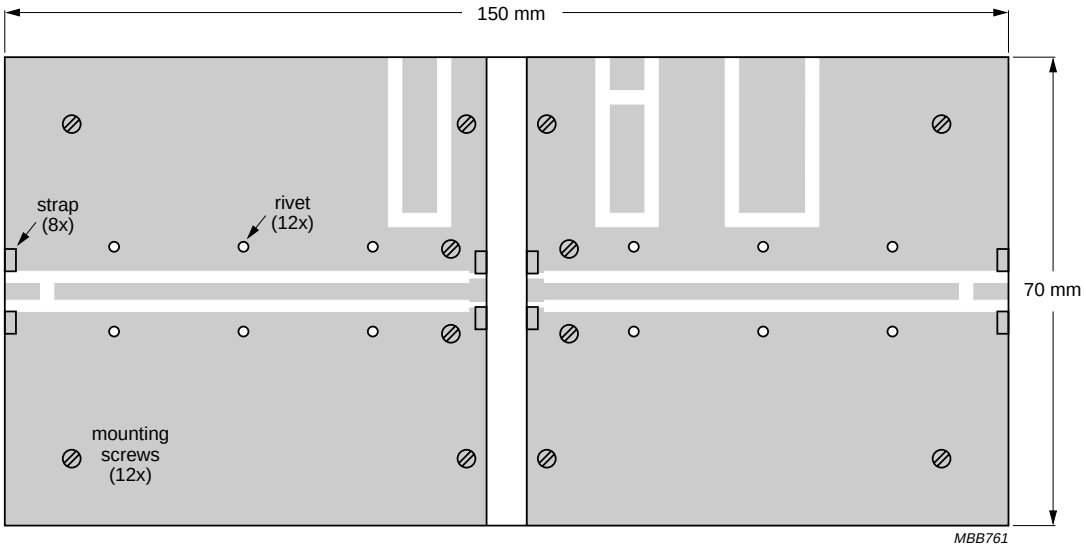
List of components (see test circuit)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C5, C13	multilayer ceramic chip capacitor (note 1)	390 pF		
C2, C4, C10, C12	film dielectric trimmer	2 to 18 pF		222 809 05217
C3, C9	multilayer ceramic chip capacitor (note 1)	39 pF		
C6	multilayer ceramic chip capacitor (note 2)	220 pF		
C7	multilayer ceramic chip capacitor	100 nF		2222 852 47104
C8	electrolytic capacitor	63 V, 10 μF		2222 030 28109
C11	multilayer ceramic chip capacitor (note 1)	10 pF		
L1	stripline (note 3)	50 Ω	11 mm × 2.5 mm	
L2	stripline (note 3)	50 Ω	37 mm × 2.5 mm	
L3	stripline (note 3)	50 Ω	13 mm × 2.5 mm	
L4, L5	stripline (note 3)	42 Ω	3 mm × 3 mm	
L6	stripline (note 3)	50 Ω	39 mm × 2.5 mm	
L7	stripline (note 3)	50 Ω	22 mm × 2.5 mm	
L8	8 turns 0.8 mm enamelled copper wire	250 nH	length 9 mm int. dia. 6 mm leads 2 × 5 mm	
L9	grade 3B Ferroxcube wideband RF choke			4312 020 36640
R1	metal film resistor	10 kΩ, 0.4 W		2322 151 71003
R2	10 turn potentiometer	50 kΩ		
R3	metal film resistor	205 kΩ, 0.4 W		2322 151 72054
R4	metal film resistor	10 Ω, 0.4 W		2322 151 71009

Notes

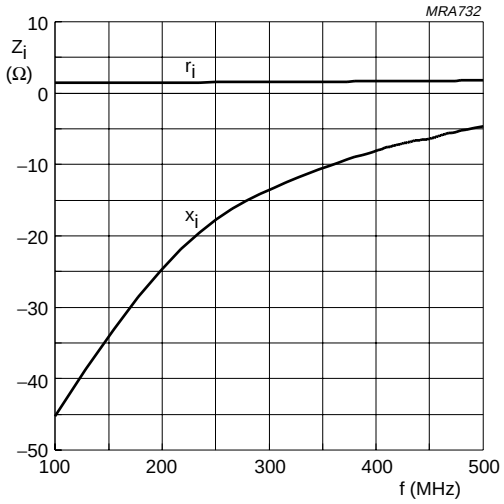
1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. American Technical Ceramics (ATC) capacitor, type 100B or other capacitor of the same quality.
3. The striplines are on a double copper-clad printed circuit board with PTFE fibre-glass dielectric (ε_r = 2.2); thickness $^1/_{32}$ inch.





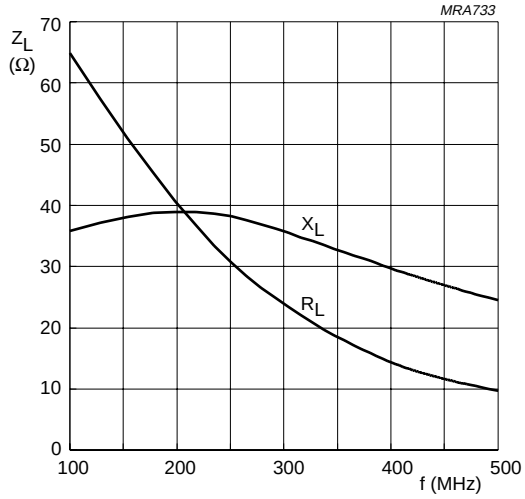
The components are mounted on one side of a copper-clad printed circuit board; the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by means of fixing screws, hollow rivets and copper foil straps, as shown.

Fig.12 Component layout for 500 MHz test circuit.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
P_L = 5 W.

Fig.13 Input impedance as a function of frequency (series components), typical values.



Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
P_L = 5 W.

Fig.14 Load impedance as a function of frequency (series components), typical values.

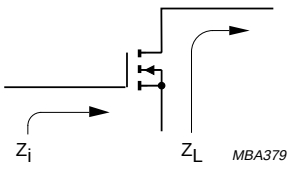
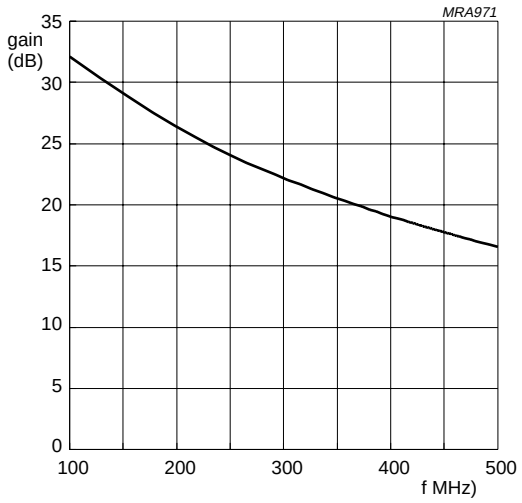


Fig.15 Definition of MOS impedance.

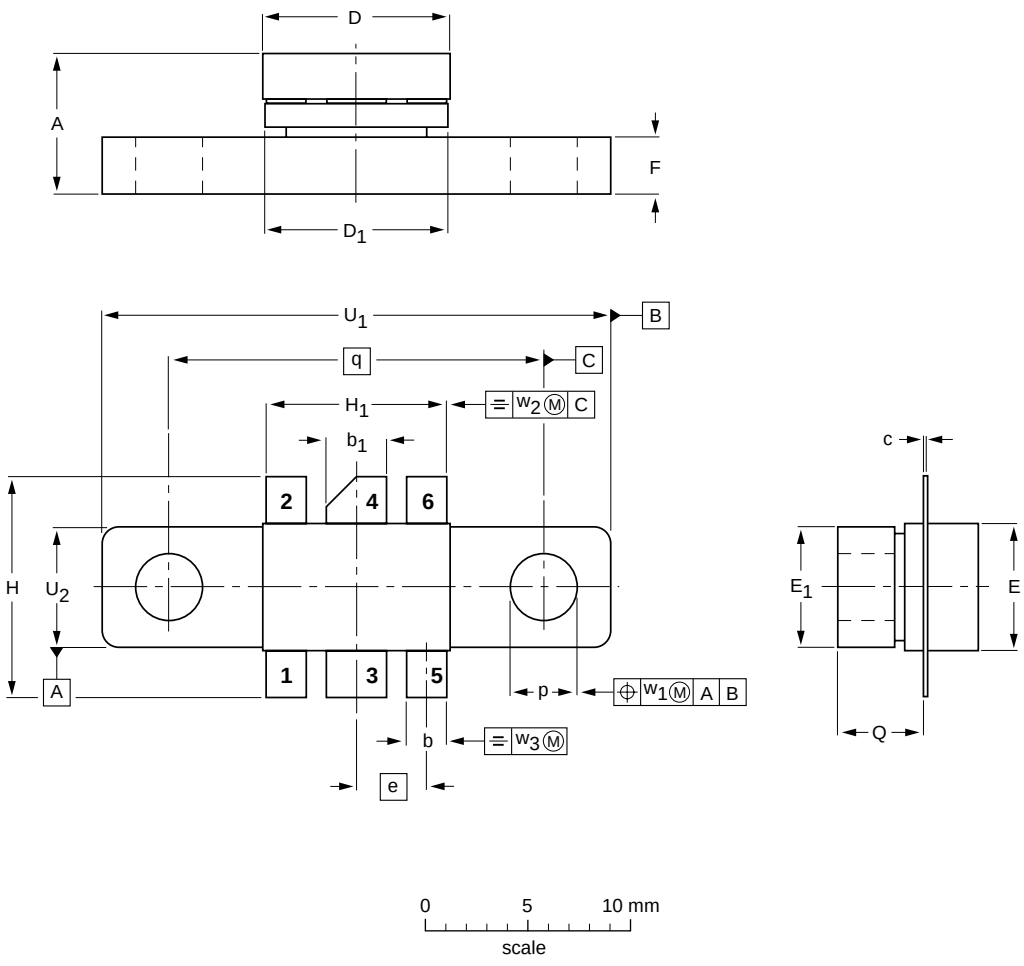


Class-B operation; V_{DS} = 28 V; I_{DQ} = 10 mA;
P_L = 5 W.

Fig.16 Power gain as a function of frequency, typical values.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads **SOT171A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	b_1	c	D	D_1	E	E_1	e	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	6.81 6.07	2.15 1.85	3.20 2.89	0.16 0.07	9.25 9.04	9.30 8.99	5.95 5.74	6.00 5.70	3.58	3.05 2.54	11.31 10.54	9.27 9.01	3.43 3.17	4.32 4.11	18.42	24.90 24.63	6.00 5.70	0.51	1.02	0.26
inches	0.268 0.239	0.085 0.073	0.126 0.114	0.006 0.003	0.364 0.356	0.366 0.354	0.234 0.226	0.236 0.224	0.140	0.120 0.100	0.445 0.415	0.365 0.355	0.135 0.125	0.170 0.162	0.725	0.980 0.970	0.236 0.224	0.02	0.04	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT171A						97-06-28

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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